


Medium Power Phase Control Thyristors (Power Modules), 50 A, 70 A, 90 A



D-55 (T-module)

FEATURES

- Electrically isolated base plate
- Types up to 1200 V_{RRM}
- 3500 V_{RMS} isolating voltage
- Simplified mechanical designs, rapid assembly
- High surge capability
- Large creepage distances
- UL E78996 approved 
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT

DESCRIPTION

These series of T-modules are intended for general purpose applications such as battery chargers, welders and plating equipment, regulated power supplies and temperature and speed control circuits. The semiconductors are electrically isolated from the metal base, allowing common heatsinks and compact assemblies to be built.

| PRIMARY CHARACTERISTICS | |
|------------------------------------|-------------------------------|
| Package | D-55 (T-module) |
| Circuit configuration | Single SCR |
| I _{T(AV)} | 50 A, 70 A, 90 A |
| V _{DRM} /V _{RRM} | 100 V, 1200 V |
| V _{TM} | 1.55 V |
| I _{GT} | 120 mA |
| T _J | -40 °C to +125 °C |
| Type | Modules - thyristor, standard |

| MAJOR RATINGS AND CHARACTERISTICS | | | | | |
|-----------------------------------|-----------------|------------------|------------------|------------------|-------------------|
| SYMBOL | CHARACTERISTICS | VALUES T50RIA | VALUES T70RIA | VALUES T90RIA | UNITS |
| I _{T(AV)} | 70 °C | 50 | 70 | 90 | A |
| I _{T(RMS)} | | 80 | 110 | 141 | A |
| I _{TSM} | 50 Hz | 1310 | 1660 | 1780 | A |
| | 60 Hz | 1370 | 1740 | 1870 | |
| I ² t | 50 Hz | 8550 | 13 860 | 15 900 | A ² s |
| | 60 Hz | 7800 | 12 650 | 14 500 | |
| I ² √t | | 85 500 | 138 500 | 159 100 | A ² √s |
| V _{RRM} | Range | 100 to 1200 | 100 to 1200 | 100 to 1200 | V |
| T _J | | | -40 to +125 | | °C |

ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS | | | | |
|-------------------------------------|--------------|--|---|---|
| TYPE NUMBER | VOLTAGE CODE | V _{RRM} /V _{DRM} , MAXIMUM REPETITIVE PEAK REVERSE AND PEAK OFF-STATE VOLTAGE V | V _{RSM} , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V | I _{RRM} /I _{DRM} MAXIMUM AT T _J = 25 °C µA |
| VS-T50RIA VS-T70RIA VS-T90RIA | 10 | 100 | 150 | 100 |
| | 20 | 200 | 300 | |
| | 40 | 400 | 500 | |
| | 60 | 600 | 700 | |
| | 80 | 800 | 900 | |
| | 100 | 1000 | 1100 | |
| | 120 | 1200 | 1300 | |



| ON-STATE CONDUCTION | | | | | | | | |
|--|---------------|--|----------------------------|---|---------------|---------------|-------------------|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES T50RIA | VALUES T70RIA | VALUES T90RIA | UNITS | |
| Maximum average on-state current at case temperature | $I_{T(AV)}$ | 180° conduction, half sine wave | | 50 | 70 | 90 | A | |
| | | | | 70 | 70 | 70 | °C | |
| Maximum RMS on-state current | $I_{T(RMS)}$ | | | 80 | 110 | 141 | A | |
| Maximum peak, one-cycle on-state, non-repetitive surge current | I_{TSM} | t = 10 ms | No voltage reappplied | Sine half wave, initial $T_J = T_J$ maximum | 1310 | 1660 | 1780 | A |
| | | t = 8.3 ms | | | 1370 | 1740 | 1870 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | | 1100 | 1400 | 1500 | |
| | | t = 8.3 ms | | | 1150 | 1460 | 1570 | |
| Maximum I^2t for fusing | I^2t | t = 10 ms | No voltage reappplied | 8550 | 13 860 | 15 900 | A ² s | |
| | | t = 8.3 ms | | 7800 | 12 650 | 14 500 | | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | 6050 | 9800 | 11 250 | | |
| | | t = 8.3 ms | | 5520 | 8950 | 10 270 | | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 to 10 ms, no voltage reappplied | | 85 500 | 138 500 | 159 100 | A ² √s | |
| Low level value of threshold voltage | $V_{T(TO)1}$ | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, T_J maximum | | 0.97 | 0.77 | 0.78 | V | |
| High level value of threshold voltage | $V_{T(TO)2}$ | $(I > \pi \times I_{T(AV)})$, T_J maximum | | 1.13 | 0.88 | 0.88 | | |
| Low level value of on-state slope resistance | r_{t1} | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, T_J maximum | | 4.1 | 3.6 | 2.9 | mΩ | |
| High level value of on-state slope resistance | r_{t2} | $(I > \pi \times I_{T(AV)})$, T_J maximum | | 3.3 | 3.2 | 2.6 | | |
| Maximum on-state voltage drop | V_{TM} | $I_{TM} = \pi \times I_{T(AV)}$, $T_J = 25\text{ °C}$, $t_p = 400\text{ }\mu\text{s}$ square Average power = $V_{T(TO)} \times I_{T(AV)} + r_f \times (I_{T(RMS)})^2$ | | 1.60 | 1.55 | 1.55 | V | |
| Maximum forward voltage drop | V_{FM} | $I_{TM} = \pi \times I_{T(AV)}$, $T_J = 25\text{ °C}$, $t_p = 400\text{ }\mu\text{s}$ square Average power = $V_{T(TO)} \times I_{T(AV)} + r_f \times (I_{T(RMS)})^2$ | | 1.60 | 1.55 | 1.55 | V | |
| Maximum holding current | I_H | Anode supply = 6 V, initial $I_T = 30\text{ A}$, $T_J = 25\text{ °C}$ | | 200 | 200 | 200 | mA | |
| Maximum latching current | I_L | Anode supply = 6 V, resistive load = 10 Ω Gate pulse: 10 V, 100 μs, $T_J = 25\text{ °C}$ | | 400 | 400 | 400 | | |

| SWITCHING | | | | |
|-------------------------------|----------|---|--------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Typical turn-on time | t_{gd} | $T_J = 25\text{ °C}$, $V_d = 50\% V_{DRM}$, $I_{TM} = 50\text{ A}$ $I_g = 500\text{ mA}$, $t_r \leq 0.5$, $t_p \geq 6\text{ }\mu\text{s}$ | 0.9 | μs |
| Typical reverse recovery time | t_{rr} | $T_J = 125\text{ °C}$, $I_{TM} = 50\text{ A}$, $t_p = 300\text{ }\mu\text{s}$, $dI/dt = 10\text{ A}/\mu\text{s}$ | 3 | |
| Typical turn-off time | t_q | $T_J = T_J$ maximum, $I_{TM} = 50\text{ A}$, $t_p = 300\text{ }\mu\text{s}$, $dI/dt = 15\text{ A}/\mu\text{s}$, $V_R = 100\text{ V}$, linear to 80 % V_{DRM} | 110 | |

| BLOCKING | | | | |
|--|--------------------------|--|--------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
| Maximum peak reverse and off-state leakage current | I_{RRM} , I_{DRM} | $T_J = T_J$ maximum | 15 | mA |
| RMS isolation voltage | V_{ISOL} | 50 Hz, circuit to base, all terminals shorted, $T_J = 25\text{ °C}$, $t = 1\text{ s}$ | 3500 | V |
| Critical rate of rise of off-state voltage | dV/dt | $T_J = T_J$ maximum, linear to 80 % rated V_{DRM} ⁽¹⁾ | 500 | V/μs |

Note

⁽¹⁾ Available with $dV/dt = 1000\text{ V}/\mu\text{s}$, to complete code add S90 i.e. T90RIA80S90



| TRIGGERING | | | | | | | |
|---|-------------|---|---------------------|---------------|---------------|------------|----|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES T50RIA | VALUES T70RIA | VALUES T90RIA | UNIT S | |
| Maximum peak gate power | P_{GM} | $T_J = T_J$ maximum, $t_p \leq 5$ ms | 10 | 12 | 12 | W | |
| Maximum average gate power | $P_{G(AV)}$ | $T_J = T_J$ maximum, $f = 50$ Hz | 2.5 | 3 | 3 | | |
| Maximum peak gate current | I_{GM} | $T_J = T_J$ maximum, $t_p \leq 5$ ms | 2.5 | 3 | 3 | A | |
| Maximum peak negative gate voltage | $-V_{GT}$ | | 10 | 10 | 10 | V | |
| Maximum required DC gate voltage to trigger | V_{GT} | Anode supply = 6 V, resistive load; $R_a = 1 \Omega$ | $T_J = -40$ °C | 4.0 | 4.0 | 4.0 | V |
| | | | $T_J = 25$ °C | 2.5 | 2.5 | 2.5 | |
| | | | $T_J = T_J$ maximum | 1.5 | 1.5 | 1.5 | |
| Maximum required DC gate current to trigger | I_{GT} | | $T_J = -40$ °C | 250 | 270 | 270 | mA |
| | | | $T_J = 25$ °C | 100 | 120 | 120 | |
| | | | $T_J = T_J$ maximum | 50 | 60 | 60 | |
| Maximum gate voltage that will not trigger | V_{GD} | $T_J = T_J$ maximum, rated V_{DRM} applied | 0.2 | 0.2 | 0.2 | V | |
| Maximum gate current that will not trigger | I_{GD} | | 5.0 | 6.0 | 6.0 | mA | |
| Maximum rate of rise of turned-on current | di/dt | $V_D = 0.67$ rated V_{DRM} , $I_{TM} = 2 \times$ rated di/dt $I_g = 400$ mA for T50RIA and $I_g = 500$ mA for T70RIA/T90RIA; $t_r < 0.5 \mu s$, $t_p \geq 6 \mu s$ For repetitive value use 40 % non-repetitive per JEDEC® STD. RS397, 5.2.2.6 | 200 | 200 | 200 | A/ μs | |
| | | | 180 | 180 | 180 | | |
| | | | 160 | 160 | 160 | | |
| | | | 150 | 150 | 150 | | |

| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | | |
|---|------------|--|-------------------------------------|----------------|---------------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES T50RIA | VALUES T70RIA | VALUES T90RIA | UNITS |
| Maximum junction operating temperature range | T_J | | -40 to +125 | | | °C |
| Maximum storage temperature range | T_{Stg} | | -40 to +150 | | | |
| Maximum thermal resistance, junction to case per junction | R_{thJC} | DC operation | 0.65 | 0.50 | 0.38 | K/W |
| Maximum thermal resistance, case to heatsink | R_{thCS} | Mounting surface, smooth, flat and greased | 0.2 | | | |
| Mounting torque, ± 10 % to heatsink terminals | | Non-lubricated threads | M3.5 mounting screws ⁽¹⁾ | 1.3 \pm 10 % | | Nm |
| | | | M5 screw terminals | 3 \pm 10 % | | |
| Approximate weight | | | 54 | | | g |
| Case style | | | D-55 (T-module) | | | |

Note

⁽¹⁾ A mounting compound is recommended and the torque should be rechecked after a period of 3 hours to allow for the spread of the compound

| ΔR CONDUCTION PER JUNCTION | | | | | | | | | | | |
|------------------------------------|--|------|------|------|------|---|------|------|------|------|-------|
| DEVICES | SINUSOIDAL CONDUCTION AT T_J MAXIMUM | | | | | RECTANGULAR CONDUCTION AT T_J MAXIMUM | | | | | UNITS |
| | 180° | 120° | 90° | 60° | 30° | 180° | 120° | 90° | 60° | 30° | |
| T50RIA | 0.08 | 0.10 | 0.13 | 0.19 | 0.31 | 0.06 | 0.10 | 0.14 | 0.20 | 0.32 | K/W |
| T70RIA | 0.07 | 0.08 | 0.10 | 0.14 | 0.24 | 0.05 | 0.08 | 0.11 | 0.15 | 0.24 | |
| T90RIA | 0.05 | 0.06 | 0.08 | 0.12 | 0.20 | 0.04 | 0.06 | 0.09 | 0.12 | 0.20 | |

Note

- Table shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC

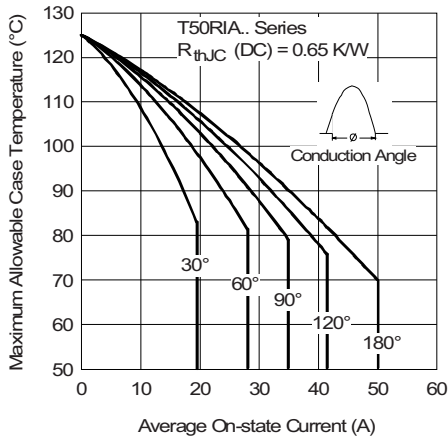


Fig. 1 - Current Ratings Characteristics

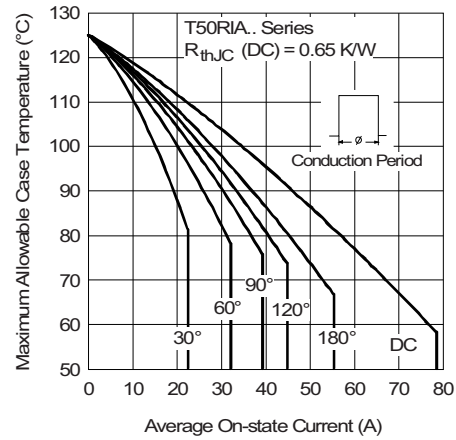


Fig. 2 - Current Ratings Characteristics

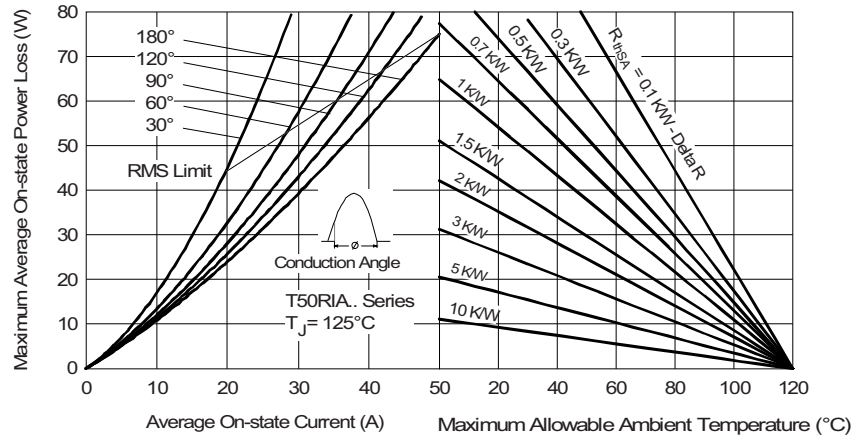


Fig. 3 - On-State Power Loss Characteristics

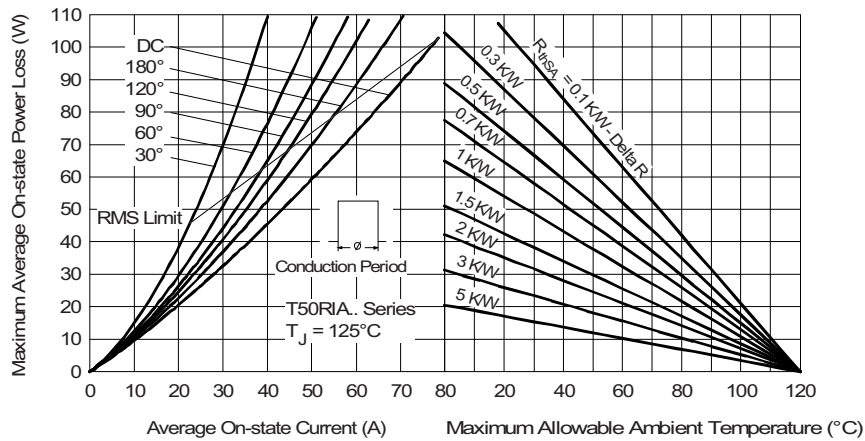


Fig. 4 - On-State Power Loss Characteristics

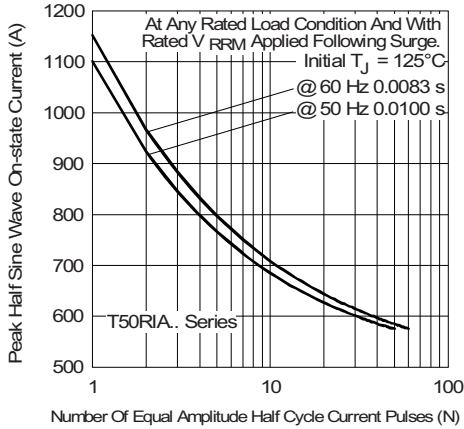


Fig. 5 - Maximum Non-Repetitive Surge Current

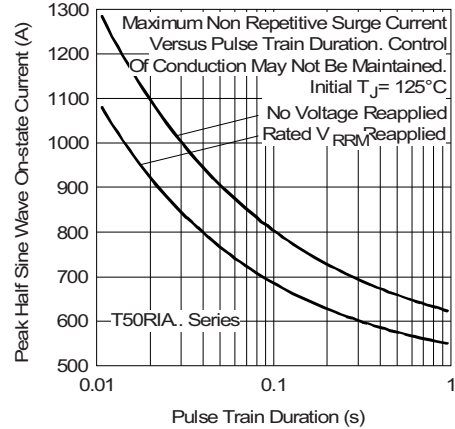


Fig. 6 - Maximum Non-Repetitive Surge Current

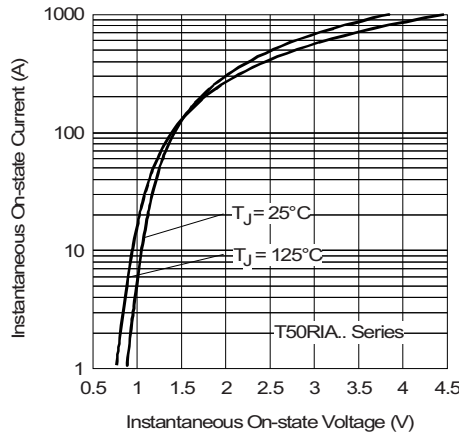


Fig. 7 - On-State Voltage Drop Characteristics

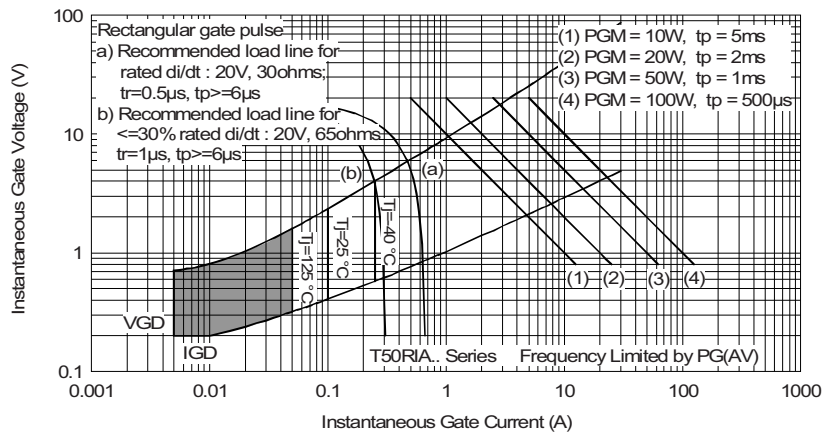


Fig. 8 - Gate Characteristics

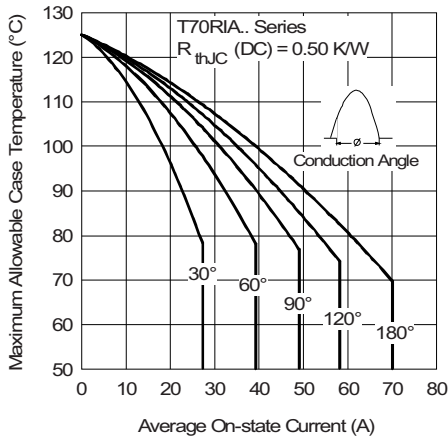


Fig. 9 - Current Ratings Characteristics

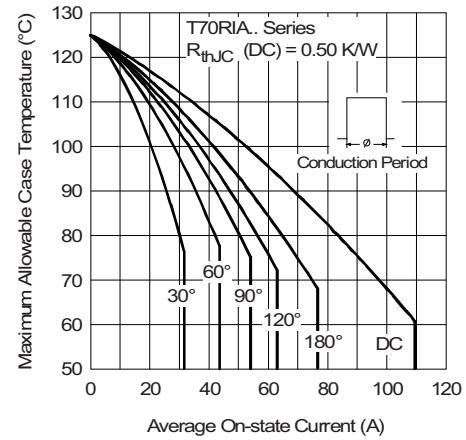


Fig. 10 - Current Ratings Characteristics

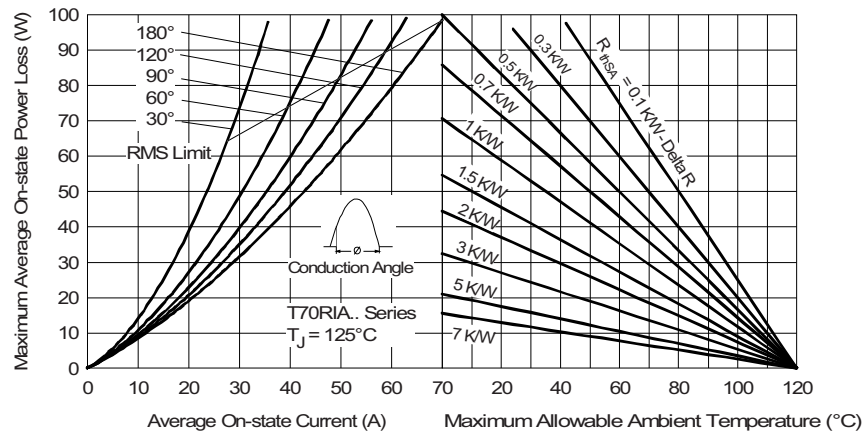


Fig. 11 - On-State Power Loss Characteristics

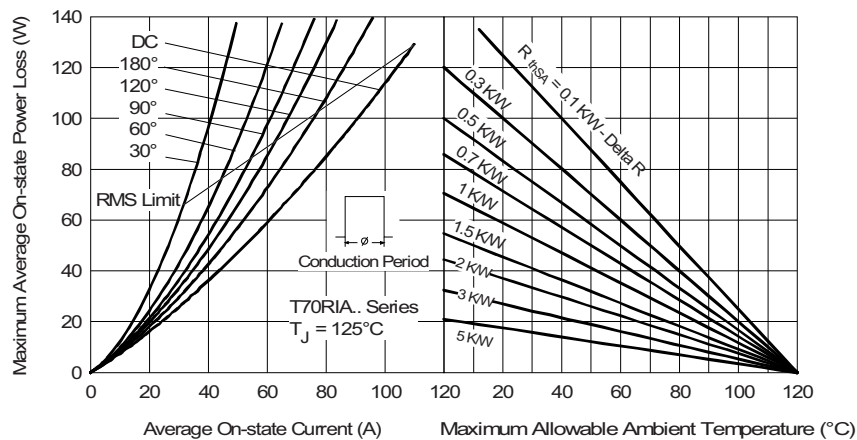


Fig. 12 - On-State Power Loss Characteristics

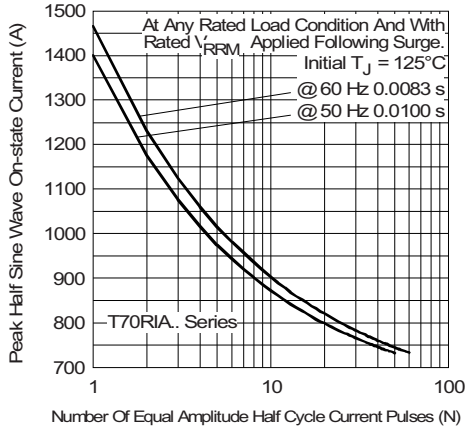


Fig. 13 - Maximum Non-Repetitive Surge Current

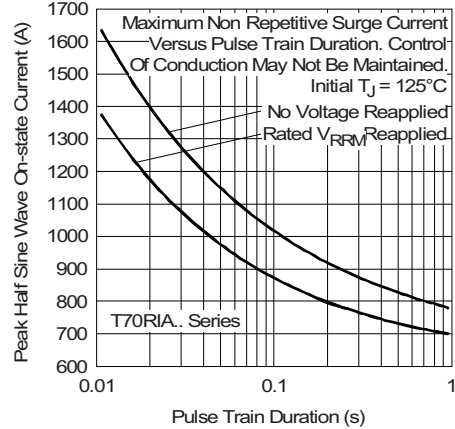


Fig. 14 - Maximum Non-Repetitive Surge Current

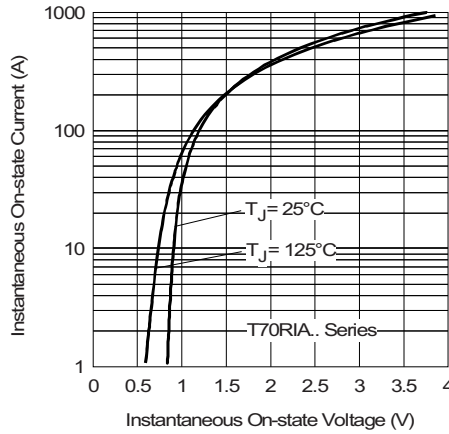


Fig. 15 - On-State Voltage Drop Characteristics

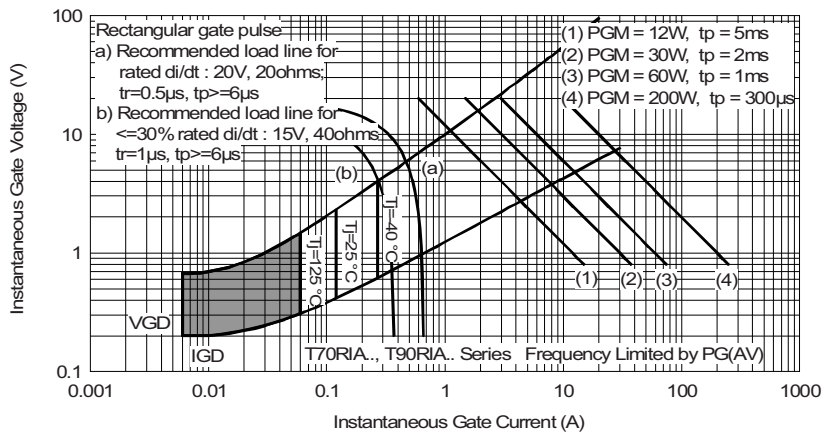


Fig. 16 - Gate Characteristics

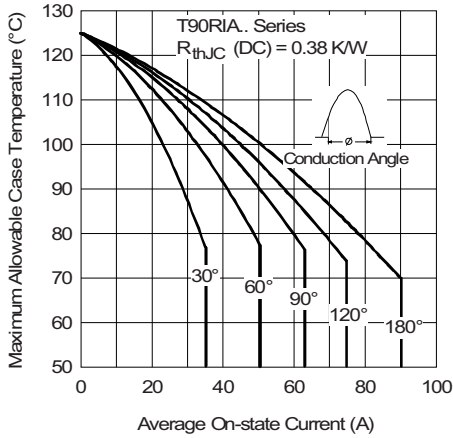


Fig. 17 - Current Ratings Characteristics

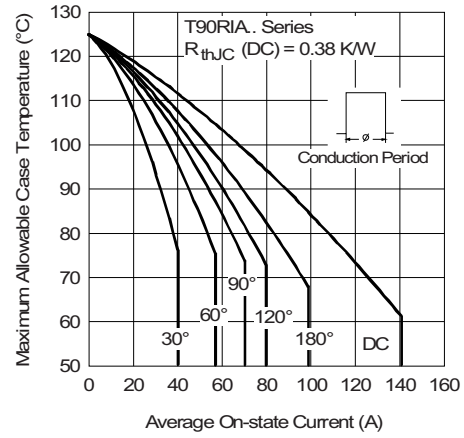


Fig. 18 - Current Ratings Characteristics

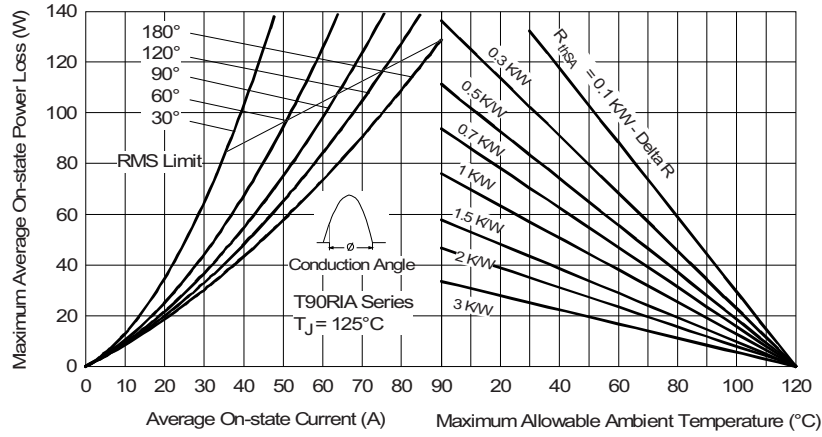


Fig. 19 - On-State Power Loss Characteristics

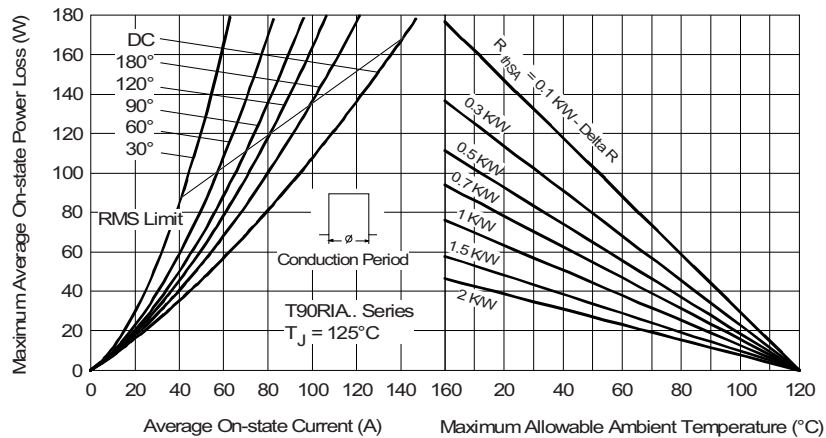


Fig. 20 - On-State Power Loss Characteristics

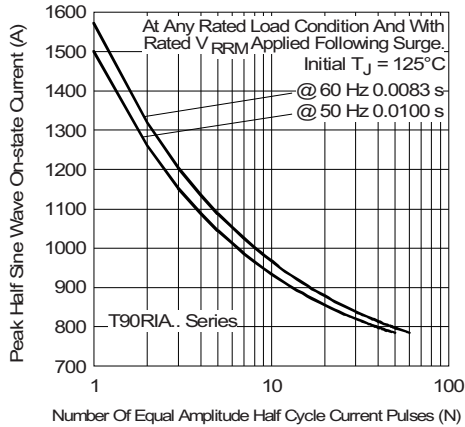


Fig. 21 - Maximum Non-Repetitive Surge Current

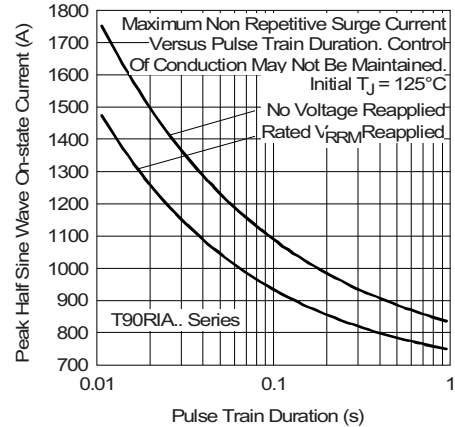


Fig. 22 - Maximum Non-Repetitive Surge Current

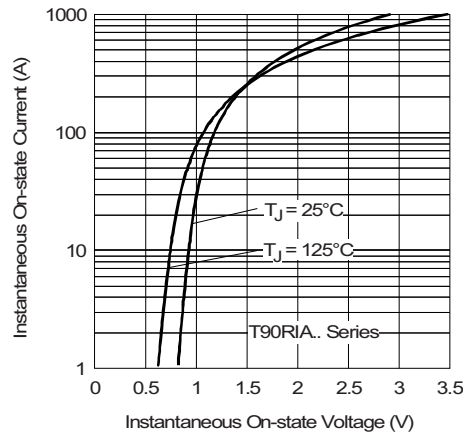


Fig. 23 - On-State Voltage Drop Characteristics

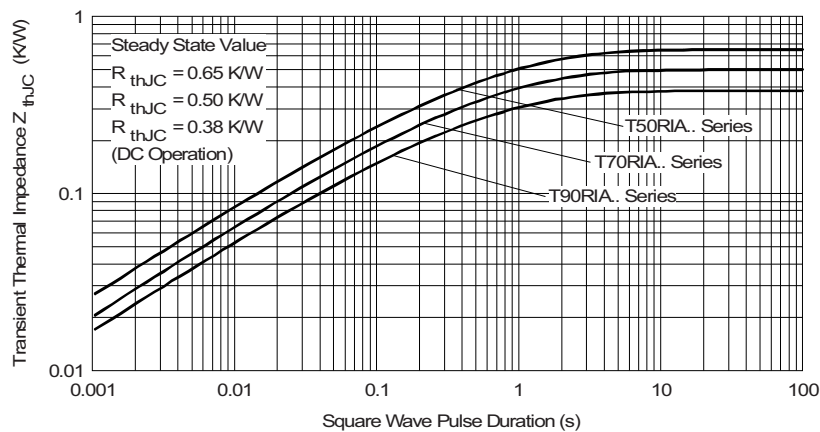
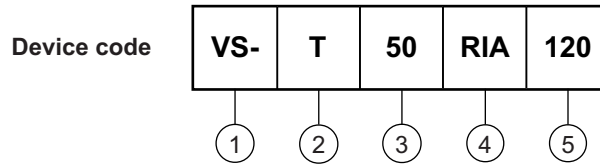


Fig. 24 - Thermal Impedance Z_{thJC} Characteristics



ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Module type
- 3** - Current rating
- 4** - Circuit configuration
- 5** - Voltage code x 10 = V_{RRM}

| CIRCUIT CONFIGURATION | |
|------------------------------|------------------------|
| CIRCUIT DESCRIPTION | CIRCUIT DRAWING |
| Single SCR | |

| LINKS TO RELATED DOCUMENTS | |
|-----------------------------------|--|
| Dimensions | www.vishay.com/doc?95336 |



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